

ON THE ANATOMY OF *TAENIA* *FESTIVA*, RUDOLPHI, 1819

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CITTOTAENIA FESTIVA (Rudolphi, 1819).

Synonym:—*Moniezia festiva*, Blanchard, 1891.

In 1819 Rudolphi described a cestode, *Taenia festiva*, from the bile duct and gall bladder of *Halmaturi gigantei* (= *Macropus giganteus*). This was later figured by Bremser in 1824, and was identified by Cobbold (1879) as occurring in *Macropus derbyanus*. Blanchard, in 1891, included it in his genus *Moniezia*. As Rudolphi's description does not give sufficient anatomical details, it has remained in Cestode Classification as a doubtful *Moniezia*.

Since 1819 other cestodes with bilateral pores have been described from kangaroos and allied animals, viz.:—

Taenia fimbriata, Krefft, 1873 = *Taenia?* *krefftii*, Johnston, 1909.

Taenia bipapillosa, Leidy, 1875, from a wombat.

Cittotaenia zschokkei, Janicki, 1905, from *Macropus* sp.?

Moniezia diaphana, Zschokke, 1907, from **Phaseolomys wombat*.

Cittotaenia bancrofti, Johnston, 1912, from *Onychogale frenata*.

Cittotaenia lagorchestis, Lewis, 1914, from *Lagorchestes conspicillatus*.

Cittotaenia villosa, Lewis, 1914, from *Lagorchestes conspicillatus*.†

* Johnston (1911) questions the correct identification of this host or the locality from which the host is recorded, as *P. wombat* does not occur on the mainland but in Tasmania or the neighbouring island of the Bass Straits.

† *T. phalangistae*, Krefft (1873), from the common opossum need not any longer be taken into account, as it is not recognisable from the description.

Johnston (1909) stated that he had recently examined superficially some material from *Macropus derbyanus* which apparently consisted of *Moniezia festiva*. He also mentioned that he has in his possession a number of tapeworms agreeing externally with *Taenia bipapillosa*, taken from a wombat, *Phaseolomys mitchelli*, and remarked 'I hope that before long I shall be able to make known the structure of these two species of *Moniezia*.' In 1912 he described a *Cittotaenia*, *C. bancrofti*, from a wallaby, *Onychogale frenata*, but so far, neither in this nor any other publication, has he made further mention of his specimen of *M. bipapillosa*.

All the double-pored cestodes from *Monotremes* and Marsupials which have been carefully examined have proved to belong to some species of the genus *Cittotaenia*, e.g., *C. zschokkei*, *C. bancrofti*, *C. diaphana*, *C. lagorchestis*.

According to the data given of *T. fimbriata*, Krefft (= *T. ? krefftii*, Johnston), we gather that we are dealing either with a *Moniezia* or a *Cittotaenia*, but further identification is impossible.

Leidy's description of *T. bipapillosa* is imperfect, but Johnston points out its similarity with the figures of *Taenia festiva* as given by Bremser. We may, therefore, either assume that *T. bipapillosa* is synonymous with *T. festiva* or, owing to lack of anatomical data, leave it altogether out of account.

Examination of Rudolphi's original description and of Bremser's drawings, reveals the fact that we may have 'an appearance as of four ovaries (uteri),' and that the ovaries (uteri) do not meet in the median field. At no stage in the development of a *Moniezia* is this appearance as of four uteri to be seen, nor do the uteri ever have a clear space in the median line. In a few species (e.g., *C. variabilis* and *C. diaphana*) of the genus *Cittotaenia*, however, the two uteri arise separately and may not meet in the median field. Under the circumstances we can assume that Rudolphi's *Taenia festiva* is a *Cittotaenia* and not a *Moniezia*.

This assumption is borne out by the study of cestode material collected by Dr. Bruck from a kangaroo in Golden Gate Park, California. Mr. Southwell, of the Liverpool School of Tropical Medicine, to whom it had been sent for identification, most kindly handed it over to me. The material, consisting of one complete worm and several fragments, presented upon external and superficial

examination all the characteristics of *Taenia festiva*, as described by Rudolphi, but upon detailed investigation proved to be a typical *Cittotaenia*, with the following characters :—

CITTOTAENIA FESTIVA (Rudolphi, 1819)

The worm is about 13 cm. long ('8 to 10 pollices,' Rudolphi) and up to 5 mm. broad ('2 to 3 lineas,' Rudolphi); fairly thick in the contracted portions, thin in some of the relaxed fragments ('thin and transparent,' Rudolphi). Pores bilateral, opening in the posterior portion of the lateral margins.

The segments vary in shape according to the state of contraction of the worm, and are broader than long. Mature segments average 2.6 mm. broad by 0.35 mm. long; gravid segments are 5 mm. broad by 0.72 mm. long. In the mature portions of the worm, the posterior border of each segment overlaps at least one-half of the next segment.

Head (fig. 1). This is a short truncate cone, 0.54 mm. in length, with its greatest diameter 0.68 mm. near the anterior end. A marked

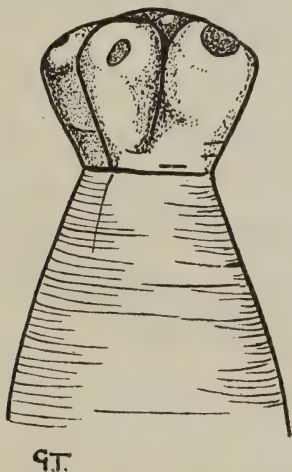


FIG. 1. *Cittotaenia festiva*. Head.

lobing is present, so that each sucker is prominent (as figured by Bremser). A certain amount of contraction is apparent. The openings of the suckers are circular and face anteriorly. Viewed *en face*, the outline of the head is square, four lobed.

Neck. A deep constriction separates the head from the rest of the strobila. It is difficult to say whether a neck is present or not, as this portion of the specimen is very contracted.

Nervous system. Ventral to the genital canals.

Muscular system. Not very strongly developed; the longitudinal muscles do not show any arrangement in definite rows.

Excretory system (fig. 3). Ventral to the genital canals. The dorsal vessel lies dorso-lateral to the ventral vessel. In some segments there appear to be transverse canals to the dorsal vessels.

Male genitalia (fig. 2). *Testes.* The testes are arranged in two groups. They number on an average forty-eight to fifty-five on the left side and sixty-four to sixty-eight on the right side. They do

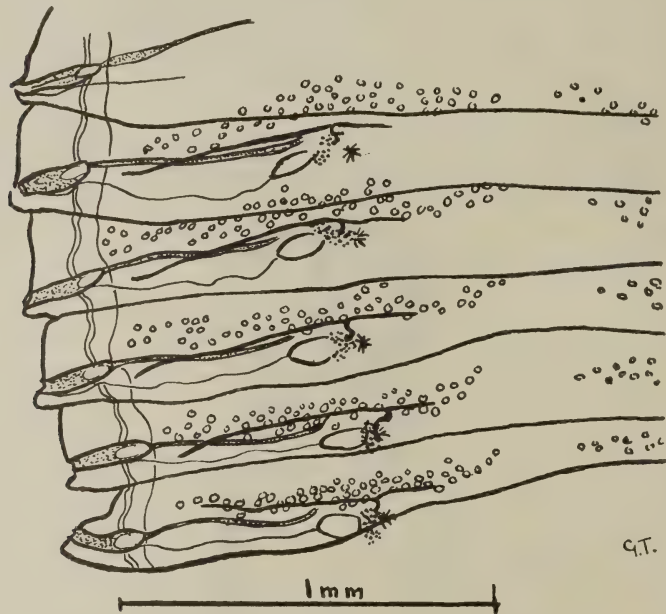


FIG. 2. *C. festiva*. *In toto* preparation of mature segment.

not meet in the median field, while laterally they reach to the longitudinal vessels. They are anterior and dorsal to the female genitalia.

Vas deferens (fig. 2). In the young segments the vas deferens appears as a straight narrow tube. Later, however, it enlarges into an elongate swelling before its entrance into the cirrus pouch; within the cirrus pouch it forms a seminal vesicle. Just median of the

enlargement, it describes a few coils and then continues as a straight and narrow tube (fig. 4). The cirrus pouch is large, slightly elongate and, before the seminal vesicle is filled with sperms, measures 240μ to 280μ by 44μ to 52μ . It reaches beyond the longitudinal canals, which it crosses dorsally.

Female genitalia (fig. 3). The fairly large mass of the shell gland adjoins the receptaculum seminis; median to this is the ovary and posteriorly the vitelline glands. The ovary may underlie the shell gland ventrally, the main bulk of the ovary lies ventral, and the vitelline gland is dorsal in position. The shell gland lies at a level between these two.

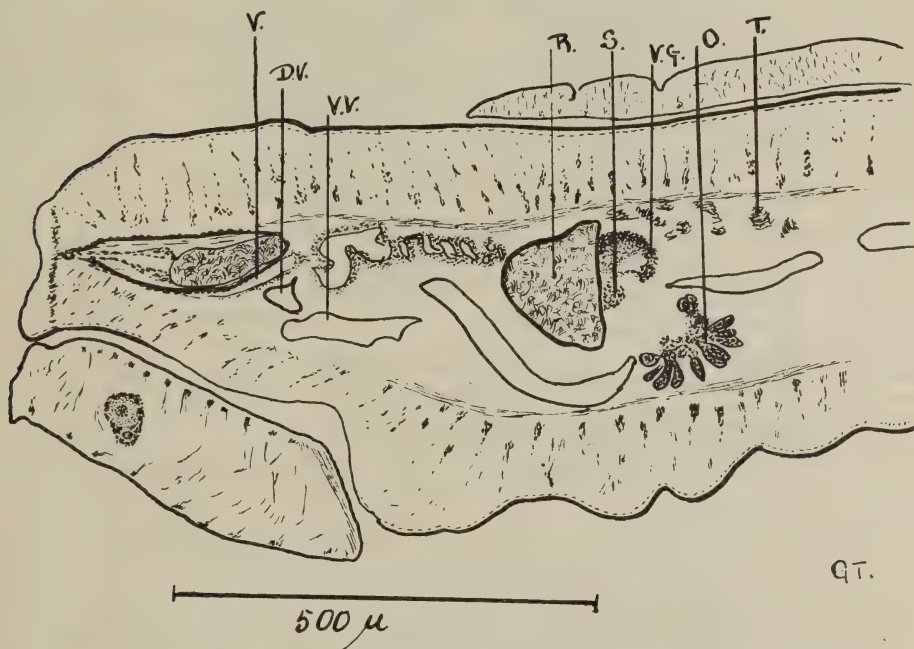


FIG. 3. *C. festiva*. Section of mature segment.

V.—Vagina; D.V.—Dorsal longitudinal vessel; V.V.—Ventral longitudinal vessel; R.—Receptaculum seminis; S.—Shell gland; V.G.—Vitelline gland; O.—Ovary; T.—Testes.

Receptaculum seminis and vagina. The vagina is ventral and posterior to the cirrus pouch on both sides. It opens on the edge of the slight collar surrounding the male aperture. In older segments the vagina disappears. The receptaculum seminis may attain enormous proportions; when filled with sperms it extends from the anterior to the posterior margin of the segment (fig. 4).

In older proglottides the two receptacula are pushed posteriorly until they divide the posterior margin of the segment into three equal parts (fig. 5).

Oviduct. After receiving the vitelline duct the large oviduct runs anteriorly for a short distance, then dips and runs diagonally, ventrally and anteriorly, meeting the uterus at a right angle.

Uterus (figs. 2 and 4). This is at first a narrow tube (one to each set of genitalia), which eventually extends from the median line to the longitudinal vessels. It may cross these latter dorsally.

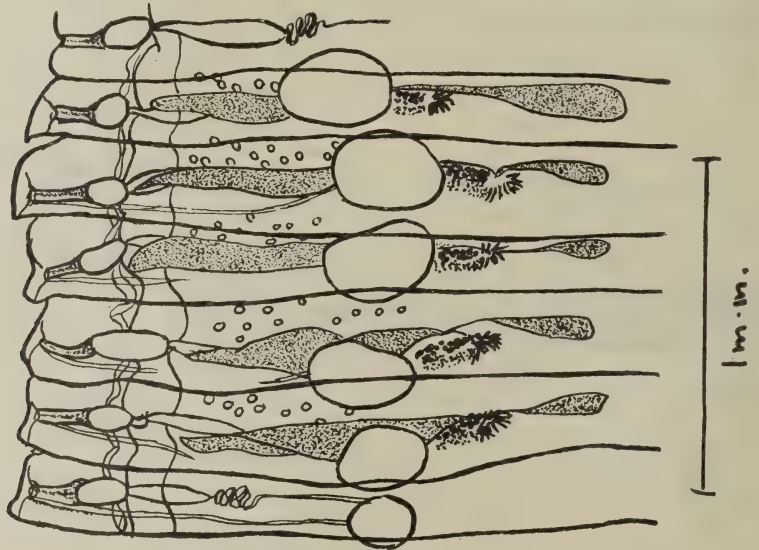


FIG. 4. *C. festiva*. Showing development of uterus.

The two uteri may meet in the median line, but they never unite. As the eggs develop the two branches of the uterus merely expand into two large pouches, giving in some segments the appearance of four separate units (as described by Rudolphi) until eventually they practically fill the whole segment (figs. 5 and 6).

Eggs. The eggs were not quite mature. Those examined in carboic acid measured 46μ to 50μ in diameter, the bulb of the pyriform body 20μ to 23μ . The horns are long, coiled and tapering.

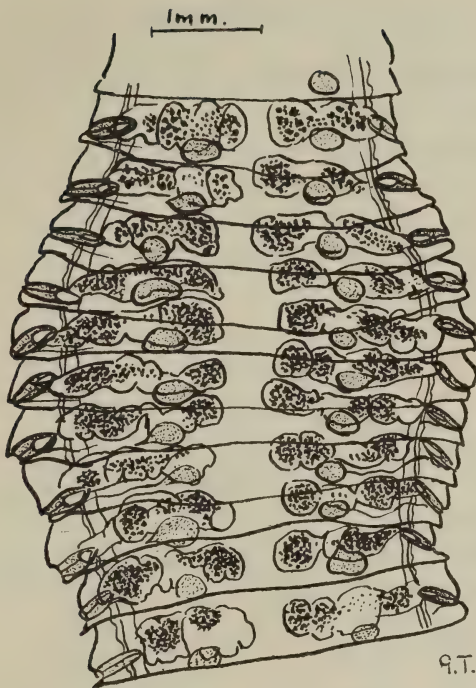


FIG. 5. *C. festiva*. Showing development of uterus.

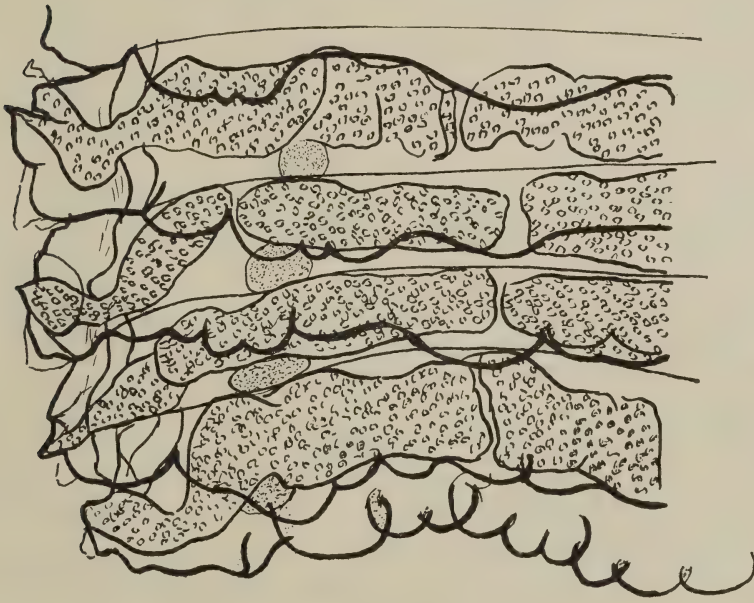


FIG. 6. *C. festiva*. Showing development of uterus ; much contracted.

DISCUSSION

The *Cittotaenia* occurring in Marsupials may be divided into two classes :—

(1) Fimbriated :

C. zschokkei,
C. lagorchestis,
C. villosa.

(2) Non-fimbriated :

C. diaphana,
C. bancrofti,
C. festiva.

Krefft (1873) describes a fimbriated cestode, *T. fimbriata*, from a *Haematurus* spp., but as his description is incomplete, his species can now hardly stand.

The following table gives a comparison of the main characters of the three non-fimbriated species :—

TABLE I.

	<i>C. diaphana</i>	<i>C. bancrofti</i>	<i>C. festiva</i>
Length	60 to 90 mm.	150 mm.	130 mm.
Maximum breadth	3·5 to 3·9 mm.	14 mm. (?)	5 mm.
Diameter of Scolex	1 mm.	1·9 mm.	0·68 mm.
Cirrus pouch ...	Slender and elongate	Large, elongate, 0·8 to 1 mm.	Elongate.
Cirrus	Short, thread-like	With spine	Thread-like
Vas deferens ...	Much convoluted	Closely coiled near cirrus sac	Straight course, except for a few coils behind the enlargement.
Testes	Two separate groups	Not distinguishable in the specimens	Two separate groups.
Ovaries	Dorsal, median, anterior	Median and anterior	Ventral, median, anterior.
Vitellogene glands	Ventral, posterior	Posterior	Dorsal, posterior.
Uterus	Two. May pass between excretory vessels	Two	Two. Cross excretory vessels dorsally only.
Eggs	Horns short	—	Horns long, tapering coiled.

C. festiva is thus seen to approach *C. diaphana* most closely, the main points of difference being that in *C. diaphana* the vas deferens is much convoluted (fig. 7), and the ovaries occupy a dorsal position, whereas in *C. festiva* there are hardly any convolutions in the vas deferens, and the ovaries lie ventral. For *C. diaphana* the horns of the pyriform body are given as short, whereas in my specimen, which was not quite mature, the horns were long and tapering. *C. diaphana* and *C. festiva* so closely resemble one another in all

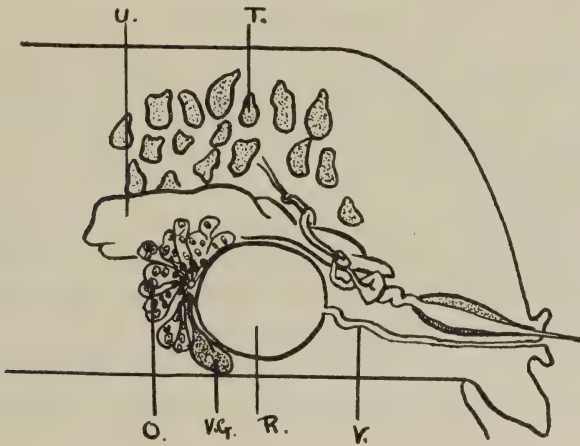


FIG. 7. *C. diaphana*. Mature proglottis after Zschokke.

U.—Uterus; T.—Testes; O.—Ovary; V.G.—Vitellogene gland; R.—Receptaculum seminis; V.—Vagina.

respects (except for a few slight differences which might easily be due to contraction) that the writer is inclined to believe that they are identical. The dorsal position attributed to the ovary by Zschokke, however, cannot be explained away by contraction; so until more work has been done on the *Cittotaenia* of Marsupials, *C. diaphana* and *C. festiva* must be considered as two separate species.

Since going to press, the writer's attention has been drawn to a publication by Nybelin (1917). In this paper, upon the examination of Rudolphi's original specimen and the new material

at his disposal, Nybelin decides to create a new genus—*Hepatotaenia* for *T. festiva*, Rud. 1819. The genus *Hepatotaenia* differs from the genus *Cittotaenia* in the following respects:—Testes arranged in two groups which do not meet in the median field, and are near to the anterior end of the female genitalia. Vagina opens behind the male genital opening. The two sacciform uteri never fuse with each other.

In this genus he includes:—

H. festiva, Rudolphi.

H. diaphana, Zschokke.

H. fellicola, Nybelin (1917).

The writer's specimen agrees in every respect with Nybelin's description of Rudolphi's *T. festiva*, and is, therefore, to be considered as a *Hepatotaenia* and not a *Cittotaenia*.

For the species *C. bancrofti*, *C. zschokkei* and *C. lagorchestis*, Nybelin creates the genus *Progamotaenia*, which differs from *Hepatotaenia* in that the gravid segments contain but one sacciform uterus, which may or may not have been double when young.

The eggs possess no pyriform apparatus.

Nybelin is inclined to put *C. papillosa* in a genus by itself, as in this species the testes are arranged in two large testicular sacs.

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